THE CLEAN DEVELOPMENT MECHANISM: THE INVESTOR'S POSITION

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ABSTRACT

The Clean Development Mechanism (CDM) allows private investors to implement projects that reduce the emission of greenhouse gasses (GHGs) in non-Annex I countries and sell these reductions to Annex I Parties or funds. This article analyses whether CDM is an attractive opportunity for private investors. First, we describe the main interests of the actors involved in CDM: the investor, the CDM authorities, the investing country's and host country's governments and the partner businesses in the host country. Second, the article analyses the specific revenues and costs connected with CDM. A model is introduced to indicate the potential emission reductions of a project. Two case studies review whether CDM is attractive to a large private investor.

The article shows several tensions between interests. The CDM authority and investing and host country's governments aim at additional emission reductions and sustainable development, investors at a profit. The former list many criteria for a sound CDM project, the latter demand simple and clear procedures. Further, the host country's government might demand extra benefits, reducing the investor's profits. These tensions call for negotiations and trigger transaction costs.

CDM can cause high transaction costs. The cost-benefit structure of CDM causes the instrument to be especially attractive for large, internationally operating companies that apply large add-on projects as CDM. This might harm the environmental integrity of the instrument. To ensure that CDM brings about cleaner development in the host countries, it is essential the instrument attracts first instance CDM projects introducing cleaner technologies. To stimulate this, incremental transaction costs should be kept at a minimum, fostered by clear and straightforward procedures. The case studies confirm that add on CDM projects can be very attractive for large, and less attractive for smaller projects.

CDM does offer an attractive opportunity to both investors and cleaner development, if the method for baselines is settled and the conditions for certification are transparent. If many different criteria will be included into the CDM, it will have a tendency to crowd out the aspect of clean development co-operation, instead of creating an additional market-based incentive for the transfer of cleaner technology.

Key words: Clean Development Mechanism, interests, revenues, transaction costs, attractiveness, investors.

1 INTRODUCTION

The Clean Development Mechanism (CDM) is one of three flexible instruments of the Kyoto Protocol. It allows private (commercial) investors to implement projects that reduce greenhouse gas (GHG) emissions in non-Annex I countries (developing countries and economies in transition) and then sell these reductions to Annex I Parties (industrialised countries). CDM has a dual objective. First, Annex I countries can use the instrument to (partly) meet their commitments on greenhouse gas emission reductions abroad, lowering total compliance costs. Second, CDM is intended to foster sustainable development in non-Annex I countries [UN, 1997].

The UNFCCC[1] defines four extremely broad categories of CDM projects: energy efficiency, renewable energy, fuel switch and agriculture and forestry projects [Van der Gaast, Woerdman, 1999, p.4]. The eligibility of sinks and nuclear energy projects are under debate [see e.g. JIN, 2000, p.5]. The basic requirements for an investor to qualify a project as CDM are that the project contributes to sustainable development in the host country and generates emission reductions that are additional to those that would have occurred without the project activity. Only emission reductions that are certified by the relevant CDM authority (CERs, Certified Emission Reductions) are marketable and have an economic value. Figure 1 shows the basic principle of CDM.

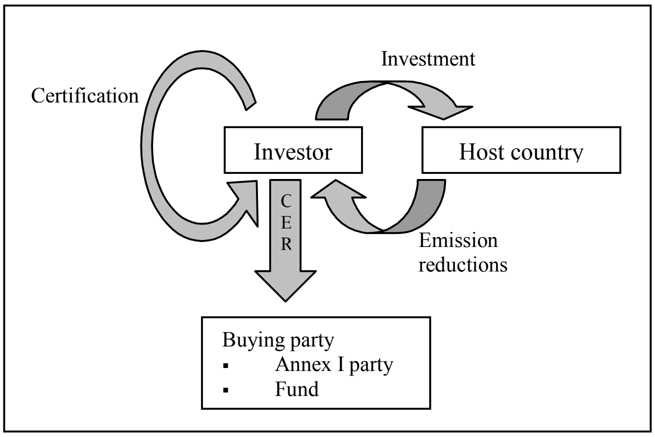

Figure 1: The basic principle of CDM

This paper addresses the question whether CDM is an attractive opportunity for private (commercial) investors. It does so in two steps. First, Section 2 gives insight in preconditions an investor has to meet by identifying the main interests surrounding CDM investments and conditions that come forth from these. The findings are partly based on interviews with government and company representatives (see Annex). Second, Section 3 pays attention to the revenues and costs associated with a CDM project. This gives insight in the financial aspects or attractiveness of CDM. In this same section, we present a model to calculate the emission reductions of a CDM project. Two case studies in Section 4 illustrate our observations and conclusions. Finally, Section 5 contains the discussion and conclusions.

Currently, debate is going on about numerous issues surrounding the Clean Development Mechanism. Topics include the definition and application of terms like supplementary, baselines and sustainable development and who can decide whether a project contributes to sustainable development of the host country. The novelty of this article is its aim to shed light on the position of one of the crucial players: the investor.

2 INTERESTS IN CDM: INVESTOR'S PLAYING FIELD AND PRECONDITIONS

Next to the investor, the main interests in a CDM project are those of the CDM authorities, the investing country's government, the host country government and the partner businesses in the host country. The investor needs to deal with these interests in a balanced manner (see Figure 2).

Based on interviews[2] and literature, this Section discusses the role of these interests and the conditions that come forth from these. It will focus on the aspects that are of direct relevance to the investor.

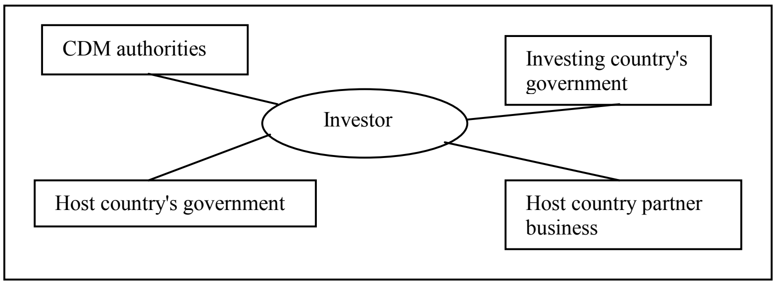

Figure 2: Main actors in a CDM project[3]

2.1 The investor

The investor puts in energy, time and money to identify, design and implement a project and often bears its risk. The investor can be a single company or a representation of several companies joined in a consortium.

Investors are unlikely to value abatement or sustainable development for their own sake, but will rather seek other interests also, like financial return, regulatory relief, reputation and strategic advantages. However, in the credited system the great majority of investors will be primarily motivated by the combined value of financial returns and credits [Parson, Fisher-Vanden, 1999, p.211, 214].

This theoretical notion is supported by the outcomes of interviews conducted for the study. On asking, the (commercial) business representatives mentioned that their main interests in CDM are to develop attractive (commercial) business activities and to enlarge their market. There is no systematic tendency towards specific project types, the projects will be developed within the companies' own expertise and technical portfolio. However, a preference exists for projects of considerable scale, since these have relatively low transaction costs (but higher risks). The main three conditions investors pose on CDM projects are that the project should fit within the technical portfolio of the company, it should be commercially feasible / attractive, and it should be possible to insure or otherwise cover the risks. The interviews revealed that at present not very many Dutch companies are active in CDM. Reasons for this are the uncertainties, the high perceived risks and that Dutch companies need more time to take well-considered actions. The commercial firms that are actively involved in CDM are mainly larger firms or consortia. This is, according to the business representatives interviewed, partly because larger firms are better able to cope with project risks, which are believed to be high in CDM. Further, larger firms have more chance to have the necessary expertise.

The investors' interest towards profits leads him to acquire from a CDM project as many CERs as possible. Therefor, they might try to certify 'regular' projects as CDM and try to get more reductions credited than are actually achieved in the project. Also, they will advocate low-cost procedures for project approval, verification and certification.

2.2 CDM authorities

The institutional framework of the CDM is not yet specified. It is clear, however, that the CDM will not be implemented by a single institution. It is likely to include a variety of entities, such as Parties, international institutions and private entities (e.g. verification offices). The Executive Board of the CDM will supervise the mechanism [Stewart, 1999]. Despite the uncertainties, the interests of the CDM authorities can be discussed based on Protocol texts and negotiation results.

The main interest of the CDM authorities is that the CDM reaches its dual goal, i.e. generate 'real' greenhouse gas emission reductions and foster sustainable development in developing countries. Thus, a project has to meet the conditions of additionality (based on a baseline study) and sustainable development. Further, the CDM authority poses procedural conditions, i.e. a project approval and registration procedure and monitoring. An investor needs to have his / her emission reductions certified by the CDM authorities. Also, the investor (or the investing country) will have to pay a levy for administrative and adaptation expenses [Stewart, 1999].

Especially the concepts of baselines and additionality are difficult to assess and require a great effort of the investor. The investor can prove additionality through a baseline study. Addressing *additionality* is the task of determining whether or not a CDM project is likely to reduce or offset emissions relative to business-as-usual [Stewart, 1999, p.32]. A *baseline* is the determination of how high emissions would have been without the project over the lifetime of a project [Van der Gaast, Woerdman, 1997, p. 881]. The literature distinguishes three notions of additionality, (i) funding additionality (CDM investments should not substitute existing funds), (ii) financial additionality (the project would not be made on commercial grounds alone, without regard to environmental objectives and CERs), and (iii) environmental additionality (the project must achieve emission reductions over and above those that would have occurred 'anyway' without the project). To date, there is no agreement yet on which notion(s) of additionality to use and how strictly to apply this.

Summarising, the CDM authority wants to ensure 'real' (additional) emission reductions. However, since CERs represent an economic value for the investor, he will claim as many CERs as possible. In response, the CDM authority poses conditions to ensure the additionality of the emission reductions it certifies. These conditions require an effort from the investor and lead to transaction costs.

2.3 Host country's government

By definition, host countries in CDM are developing countries or economies in transition. Although each country is unique and its government has its own preferences, some general observations will be made.

Since many non-Annex I countries are coping with severe problems like poverty, the reduction of greenhouse gas emissions is not the first priority in these countries. Although they will emphasise the environmental integrity of the instrument (i.e. the instrument generates 'real' reductions compared to business-as-usual), they will seek benefits in CDM projects besides and above GHG reductions [JIN, 2000, p.1]. The Kyoto Protocol clearly underwrites this by stating that one purpose of the CDM shall be to 'assist

Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention…' [Kyoto Protocol, art.12]. Following this line of argument, the interests of the host countries in CDM projects will mainly focus on economic, technical and social benefits for the country and on promoting sustainability.

CDM is based on voluntary participation of all parties involved [Kyoto Protocol, art. 12/sub5a]. The emphasis in CDM on voluntary participation and host-country sustainable development is meant to meet the concerns of developing countries that CDM projects could be forced upon them, making them unable to either control local impacts or to negotiate a satisfactory sharing of benefits [Parson, Fisher-Vanden, 1999, p. 211]. Voluntary participation means the host country, as a project partner, has to agree to the CDM project[4]. This implies it is important for an investor to pay attention to the interest and conditions of the host country. Even stronger, KPMG [1999, p. 4,6] states that practice shows that investment projects that do not or not sufficiently fit the interests of the host country are doomed to fail. For the investor this means that he will have to share the (financial) benefits of the CDM project to meet host country interests.

2.4 Investing country's government

Governments of investing countries may be driven by various factors to engage in CDM. Here, we will focus on those interests that influence the investor. The exact interests and conditions are county specific, but may largely overlap between Annex I countries. After some general remarks, we will shortly address Dutch policy on CDM to provide some practical insights.

One of the purposes of the CDM is to '.. assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitment ..' [Kyoto Protocol, art. 12/sub 2]. The rationale behind this is that CDM, as one of the flexible instruments, has the potential to reduce the compliance costs of Annex I Parties by equalising marginal abatement costs across nations [OECD, 1999, p.3]. Thus, Annex I governments will be interested in CERs that are cheaper than emission reductions achieved domestically. This implies that the investor will only be able to sell relatively cheap emission reductions. In addition, Annex I governments may want to protect the integrity of the CDM by requiring (as the CDM authority) real or additional emission reductions, not accepting reductions that only exist on paper.

As a reaction to the Kyoto Protocol, and in order to achieve the accepted reduction requirements, Dutch government is developing a national program for CDM, under which investors can participate. Dutch government wants the type of investments under CDM to be those that combine emission reductions with sustainable development goals. All of this has to fit into the 'overall' policy of the Ministry of Foreign Affairs (Development Co-operation). This policy is characterised by a demand approach, country lists, a sectoral approach and the so-called GAVIM-principles, which require a focus on good governance, combatting poverty, women, institutional development and (local) environment [VROM, 2000].

The main criteria Dutch government poses on flexible instruments are that the projects should provide reductions cheaper than domestic, and be qualitatively good (i.e. be likely to pass the test of validation and certification). In addition, it will specify a set of governing criteria for CDM [VROM, 2000]. The exact procedure and criteria are not known yet.

2.5 Host country business

In many instances, the investor will co-operate with one or more companies in the host country. These host country businesses typically are project implementers. As argued by Parson and Fisher-Vanden [1999, p.213], professional implementers will participate in CDM primarily to advance commercial interests, through contractual arrangements combining fixed payments with shares of project financial returns or credits. The host country business may also claim property or production rights after a certain period. Thus, the main condition for the investor posed by the host country partner business is a satisfactory sharing of benefits.

2.6 Concluding remarks

This section shows that an investor in CDM must meet many interests. The two critical parties for the investor to get CDM approval are the CDM authorities and the host country's government. The CDM authorities have to approve the project as CDM and certify the emission reductions, while the host country has to give explicit approval for the project. Although the interests of the other parties may frustrate the implementation of the project or the selling of CERs, they are not decisive for the certification / crediting of the project.

The analysis shows that there are several tensions between interests. The CDM authority and investing and host country's governments aim at additional emission reductions and sustainable development, investors at a profit. The former would like to apply many criteria for a sound CDM project, the latter demand simple and clear procedures. Further, the host country's government and business might demand extra benefits, reducing the investor's profits. These tensions call for negotiations and trigger transaction costs.

An investor should be aware of the playing field when considering to engage in CDM. CDM is only attractive to an investor when he / she can adhere to the various interests and conditions. Since many conditions are posed on CDM projects, it is probably not attractive to many investors.

As noted, the many constraints that are posed, largely invoked by conflicting interests, lead to transaction costs (for all the parties involved). These transaction costs further diminish the attractiveness of CDM to investors. The following section pays attention to this.

3 CDM COSTS AND REVENUES

In regular business life, investors will only implement a project if they anticipate a clear (financial) benefit. In a CDM project, the gain for the investor depends on the ratio of total project costs and creditable emission reductions [Michaelowa, 1998, p. 82]. The central question in this paragraph is what the (incremental) costs and revenues are that are connected with CDM. These factors determine the financial attractiveness of CDM to investors. Also, the cost and revenue characteristics will lead to some project types being favoured over others. This section is descriptive in nature, while Section 4 will discuss two quantitative case studies.

3.1 CDM costs

Compared with a 'regular project', the specific costs of a CDM project are defined by the incremental transaction and investment costs. Incremental investment costs are caused by extra investments and the costs to finance these. Transaction costs typically consist of search costs, negotiation costs, approval costs, monitoring costs, enforcement costs and insurance costs [Dudek and Wiener, 1996].

To define the 'regular project', a distinction is needed between 'first instance' CDM projects and 'add on' CDM projects. The first are projects that were intended as CDM from the start. The investor on purpose identified a CDM project. For this category, a regular project can be defined as other business opportunities of the investor apart from CDM. The latter are projects that were already identified as a business project, before the investor started thinking of applying it as a CDM project. For this category, the regular project could be defined as the project without the CDM characteristic added onto it.

The most usable cost estimates come across during this study are those of the Nordic Council of Ministers [1997]. These results are based on 10 AIJ projects, and are often quoted in literature[5]. According to the Council, the transaction costs of a JI (or CDM) project are the additional costs of the project in comparison with a corresponding project implemented domestically. The transaction costs consist of two elements:

(1) A general cost element due to the fact that this is a bilateral (or multilateral) project. This comprises costs of project identification, evaluation and administration costs. These costs correspond to the costs for other bilateral projects, known for instance from development assistance projects. This cost element is assumed to be relative, at a total of approximately 12% of the summed costs of project identification, feasibility and initial investment. For projects based on loans, transactions costs will be higher, caused by the extra precautions to reduce the risk;

(2) Costs due to the fact that this is a JI (or CDM) project. These are the costs of JI application, documentation, verifying, control and crediting, i.e. costs that depend on the institutional concept. The Council assumes these costs are relatively fixed, and the costs are estimated at approximately 30,000 $ per project, which is between 0.2 and 8% of the initial investment[6]. The ultimate height will be highly dependent on the institutional organisation chosen for the instrument.

For first instance CDM projects, that have CDM as the main focus, both cost elements (1) and (2) are relevant. Category 1 then consists of the incremental costs relative to other (domestic) investment opportunities. If in regular business life the investor also implements bi- or multilateral projects, the *incremental* general transactions costs (cat. 1) of a CDM project may be low or even negligible for him. For add-on CDM projects, the general transaction costs mentioned under category 1 are sunk costs at the moment the investor decides whether or not to register the project as CDM. Only cost category 2 is then relevant in the decision making process.

3.2 CDM Revenues

When the CDM authorities approve the emission reductions an investor claims for a project, the investor receives Certified Emission Reductions (CERs; 1 CER equals 1 ton CO_2-equivalents). Since the investor can sell these CERs to Annex I countries' governments (or intermediate funds), they represent an economic value. The potential

CDM revenues of a project are determined by the amount of emission reductions that are achieved and the price that Annex I governments or funds pay for the certified reductions.

Amount of emission reductions
The emission reductions of a CDM project are measured as the difference between the estimated future emissions at the project location in absence of the investment under the project (the baseline) and the project's actual GHG emissions [Van der Gaast, Woerdman, 1999, p.2]. The definition of the baseline is paramount to calculate emission reductions of a CDM project [Michaelowa, 1998, p.81]. Since the baseline situation will never actually happen, calculating a baseline is problematic. Many analysts regard the development of baseline methodologies as the most difficult task in setting rules for CDM [Stewart, 1999, p.36]. The past few years, a range of baseline-approaches has emerged in literature (see Figure 3)[7].

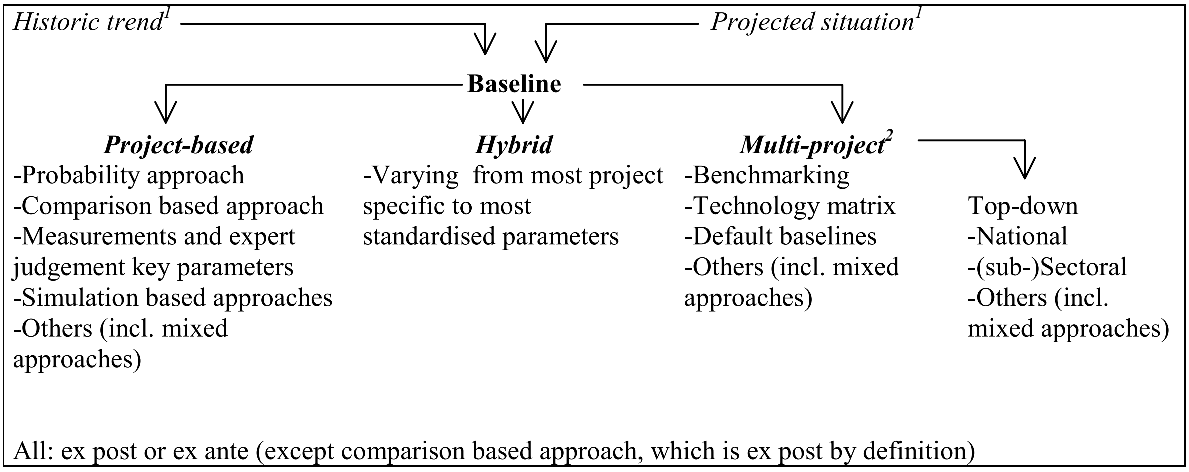

Figure 3: Possibilities in baseline setting [OECD, 1999; Ellis and Bosi, 1999; Meyers, 1999]
[1] Authors' addition
2 In literature, the multi-project and top-down approach are defined in varying ways.

Moving from a project specific to a multi-project approach, the number of standardised or aggregated baseline components increases. In a project-specific approach, all key assumptions are project specific. In a multi-project approach, all key assumptions are standardised and aggregated. Using a hybrid approach, the extent to which standardisation of the baseline is feasible will be determined by the local and regional variability of the different baseline components [Ellis and Bosi, 1999, p.17]. It is important to recognise that even under each separate approach there is a wide range of opportunities to establish a baseline. For example under the benchmark approach, one can choose to set the benchmark at the best available technology, country average, OECD average or latest investments [Ellis, Bosi, 1999, p. 12]. Also, the reference used can be historically based or based on a future (projected) situation. Finally, a baseline can be set ex ante (before the start of the project) or ex post (when the project is in operation). These different choices will significantly affect the amount of emission reductions that are attributed to a project.

For the case studies in Section 4 we developed a model to get a first (reliable) indication of the baseline and the emission reductions that can be expected in a CDM project [de Leeuw, 2000]. Second goal of the model is to provide a framework to analyse the effect of different baseline approaches. The model calculates emission reductions as the difference between the project emissions and the baseline emissions. It will be briefly reviewed here.

The *baseline emissions* are dependent on the *data level* and the *reference used*. The data level can (at the extremes) vary from project-specific (bottom-up) to top-down. A top-down approach uses national data as a basis to calculate emissions at the project-site. A bottom-up approach uses project specific information. The reference for the baseline can (at the extremes) be a historic trend or a future projected situation. Using historic trends, one calculates the baseline using historic trends (extended into the future) for the variables. It is then assumed that these trends are a good indication of what would happen in the future if the project were not implemented. When a future situation is used as a reference, one defines a situation that is expected and / or strived for, and calculates the baseline emissions accordingly. This allows for a baseline that anticipates a change in trends (very useful in for example rapidly developing countries). Combining the two variables, the model specifies four possibilities to calculate a baseline for a CDM project ((i) bottom-up based on historic trends; (ii) bottom-up based on a future situation; (iii) top-down based on historic trends; (iv) top-down based on a future situation). These four methods more or less span the field of possibilities found in literature.

The second determinant of a project's emission reductions are the emissions associated with the project itself. The model specifies two ways to calculate these *project emissions*, namely top-down, using national data, or bottom-up, using project-level data. In practice, a top-down approach can only be used for projects with a very large scale (e.g. national electricity generation changes) or for national policy actions. In most cases, a top-down approach to a project's emissions will be inappropriate.

Summarising, the model defines four ways to calculate baseline emissions and two ways to calculate project emissions. To calculate the emission *reductions* of a project, one has to subtract the project emissions from the baseline emissions. This gives eight ways to calculate the emission reductions of a project. Table 1 gives a graphical representation of the model. The numbers I-VIII represent the eight possible ways to calculate the emission reductions of a project. In for example method I, the baseline emissions are calculated using historic trends and national data (top-down). The project's emissions are calculated using project-specific data. When these two figures are subtracted, the result is the calculated emission reductions that are represented by method I. The same reasoning applies to the other seven methods specified in the model.

There are many more options to calculate emission reductions besides those specified in the model, and even under each of the eight scenarios an immense range of alternatives exists. Accordingly, the goal of the model is not to cover the whole area of baselines, but to provide a structured way to calculate emission reductions from varying perspectives, thereby giving a first indication of the amount and likely range of emission reductions achieved through the project. This is useful to both investors and verifying agencies.

Table 1: Model to calculate baselines and emission reductions for a CDM project in various ways

		Baseline emissions			
		Historic trend		***Future projected situation***	
		Top-down	*Bottom-up*	*top-down*	*bottom-up*
Project emissions	*Bottom-up*	Emission reduction (I)	Emission reduction (II)	Emission reduction (III)	Emission reduction (IV)
	Top-down	Emission reduction (V)	Emission reduction (VI)	Emission reduction (VII)	Emission reduction (VIII)

Note: Emission reduction = baseline emissions - project emissions

Price of Certified Emission Reductions (CERs)
The ultimate price of emission credits depends on supply and demand. Several simulation studies have been conducted to gain insight in the level of the market price for credits once the market is up and running. For example, ECN [1999] estimates a price of $4 - $15 per CER (energy options only), and in Van der Gaast and Woerdman [1999] several studies are reviewed with price estimates of $ 10 (G-cubed model, 1998), $ 23 (IEA, 1999) and $40 (CEA, 1998). The World Bank uses a price of $10 in its Prototype Carbon Fund [World Bank, 2000]. In most of the literature, the price of CERs is estimated at 10 to 20 dollars [Schöne, 2000, p.6].

An investor might be able to sell CERs above cost price, because credit prices do not necessarily equal the costs of emission reduction. The ultimate price of CERs represents only one point of the marginal cost curve [Woerdman, 1999, p.9]. This gives another incentive to the investor to generate CERs as cheap as possible.

3.3 Financial attractiveness of CDM projects

CDM will only be financially attractive to an investor if the incremental benefits of CDM compared with regular business opportunities outweigh the incremental costs. As was shown, the incremental benefits are determined by the price of CERs and the amount of CERs the project generates. The latter in turn highly depends on the baseline approach chosen and the definition of additionality. Strict baselines and a strict interpretation of additionality will both lower the number of CERs granted per project and the number of projects accepted by the CDM authorities. The incremental transaction costs largely depend on the institutional organisation of CDM [Nordic Council of Ministers, 1997]. The institutional organisation defines the transparency and complexity of requirements investors must meet, and thereby the necessary administrative work. Based on the reasoning in the previous section, some qualitative remarks will be made on the financial attractiveness of different types of CDM projects. Box 1 gives an illustrative example.

First instance CDM projects
Deciding on a first-instance CDM project, the investor will compare the financial performance of the CDM project with that of his regular investment opportunities. CDM is attractive when it has a financial performance (e.g. pay-back period, Net Present Value) which is at least comparable with that of other investment opportunities the investor has at that moment. However, if a strict notion of (financial) additionality is adopted in policy making, only financially meagre projects might be accepted as CDM, reducing the attractiveness of CDM[8]. Further, because of high up-front development costs, the benefits need to be rather high in order for the project to be comparable with regular business opportunities. This is because the discounting procedure in decision making will reduce benefits more than costs, since the benefits occur later in time.

First instance CDM projects will usually be more attractive to companies that already operate internationally in their regular business activities than to investors that normally operate nationally, since for the former the *incremental* general transaction costs will be lower.

Add on projects
For an add on project, the administrative work for applying the project as CDM can be put off to some time after the first start of the project. Since there is less time between CDM

transaction costs and the CDM benefits, there is more chance a project is financially feasible compared to a first instance project.
Another benefit of treating CDM as add on is that it reduces risks for the investor: if the project is not accepted as CDM, the regular profitable project can still be implemented. In case of a first instance CDM project, no project would be implemented at all, so there is no chance to cover the preparation costs.

For add on projects, it makes no difference whether the investor is a company which regular activities are mostly nationally or internationally orientated, since in CDM decision making the general transaction costs (caused by the project being a bi- or multilateral project) are sunk costs.

Example: the financial attractiveness of CDM in four different situations

A project has a total initial cost of $ 10 mln. The investor wants to apply this project as CDM. Using the results of the Nordic Council of Ministers, the general incremental transaction costs are approximately $ 1.2 mln. (12%), and the CDM specific transaction costs $ 30,000 (both compared to a domestic, non-CDM project).
Other assumptions are as follows: The project life is 21 years, year 0-4 for preparation and construction, years 5-20 are operational years. During the operational years, the project generates $ 0.1 mln. net CDM benefits. Construction and operational costs are the same for the CDM and the alternative project. The interest rate is 10%.

For assessing the financial attractiveness of the project, four situations are considered:

I. First instance CDM project, alternative is a comparable domestic project. All incremental CDM transaction cost occur in year 0;
II. First instance CDM project, alternative is a comparable bi- or multilateral project. All incremental CDM transaction cost occur in year 0;
III. Add on CDM project, alternative is the same domestic project without CDM (investor is company in non-Annex I country). All incremental CDM transaction costs occur in year 4;
IV. Add on CDM project, alternative is the same bi- or multilateral project without CDM. All incremental CDM transaction costs occur in year 4.

The finances for the four situations are as follows:

I First instance. Total incremental transaction costs (yr. 0): $1.23 mln. NPV: - $ 0.7 mln.
II First instance. Total incremental transaction costs (yr. 0): $ 0.03 mln. NPV is $ 0.44 mln.
III Add on. Total incremental transaction costs (yr. 4): $ 0.03 mln. NPV is $ 0.75 mln.
IV Add on. Total incremental transaction costs (yr. 4): $ 0.03 mln. NPV is $ 0.75 mln.

As can be seen, the project is most attractive for CDM if it has an *add-on* character. As *first instance* project, CDM is most attractive for companies that normally already operate internationally, since these have lower incremental transaction costs.

Box 1: Example on the financial attractiveness of CDM

Based on the reasoning in this section and the illustration in box 1, we conclude the following. First, most investors in CDM are expected to be companies that already operate internationally in their regular business activities. Second, mostly 'add on' projects may be expected in CDM, since these will have relatively low (discounted) transaction costs. Finally, large CDM projects will have relatively low transaction costs because of the fixed nature of CDM specific transaction costs. This will favour large-scale projects compared to smaller ones.

4 CASE STUDIES

Two case studies are reviewed to assess if these CDM projects are attractive to a large private investor. Attention is paid to the emission reductions, the potential CDM revenues and the costs to implement these CDM projects. Both projects have an add on character.

4.1 Case study Philippines: renewable energy

Emission reductions

The project in this case study involves the electrification of a village in the Philippines that is not connected to the grid. The electrification will be realised using a renewable energy source: a biomass generator feeding a local minigrid.

In short, the baseline consists of two parts: (i) the emissions of the fossil fuels that are replaced by the project (mainly kerosene for lighting), and, (ii) the emissions of the biomass, if it had not been burned in the biomass generator. Without the project, this biomass would be left to rot, producing CO_2 and CH_4 (methane). The project's emissions consist of emissions from the burning of biomass and the remaining use of conventional fossil fuels (estimated at 10% of total energy use).

The model presented in the previous Section was used to conduct four alternative baseline calculations (scenarios (I), (II), (III) and (IV)[9]). Table 2 summarises the results, including a brief description of the method by which the various baseline calculations were derived. The numbers represent totals for the entire project life. The project company expects the lifetime of the project to be 20 years. The calculations will not be explained in detail, this goes beyond the scope of this article[10].

Emission reduction costs and revenues

Table 2 shows that the estimates of the emission reductions of the project vary from 3730 to 5299 ton CO_2-eq. The estimated reduction of 7237 is not considered here, since it represents an unlikely situation (i.e. high growth in the baseline combined with small growth within the project, which means the project hinders development).

Table 2: Results of calculations of baselines and emission reductions for the Philippines case study (all figures in tons of CO_2-equivalents; numbers represent totals over entire lifetime)

		Description baseline scenario	Baseline emission	Project emission[1]	Emission reduction
Scenario	**I** Baseline: historic, top-down Project: bottom up	Linear extrapolation historic national trend (CO_2-eq./(GDP/cap)) and GDP/cap. + rotting biomass emissions	8,883	3,970	**4,914**
	II Baseline: historic, bottom up Project: bottom up	Emissions of current use of kerosene village + emissions rotting coconut	7,700	3,970	**3,730**
	III Baseline: future situation, top-down Project: bottom up	National (GDP/cap) and (emissions/(GDP/cap)) converging to current Dutch values over project period + emissions rotting coconut	11,206	(a)3,970 (b)6,071	**(a)7,237** **(b)5,135**[3]
	IV Baseline: future situation, bottom up Project: bottom up	Emissions of current use of kerosene and expected future use of diesel generators village + emissions rotting coconut [2]	9,260	3,961	**5,299**

[1] Estimate provided by the project company (except for estimate III(b), which was calculated by the author).

[2] Baseline scenario provided by the project company, based on measurements, experience from other projects and assumptions.

[3] Under (b), it is assumed growth with project equals the growth rate in the baseline. The figure is a very rough estimation of the emission reduction. (a) represents the calculation as specified in scenario (III).

The project in this case study is a pilot, one part of a bigger project. Unfortunately, it was not possible to calculate either the total CDM costs or the emission reduction costs per tonne under various scenarios, since no financial data for this single pilot project were made available. Without CDM revenues, the overall project is expected to have a positive Net Present Value at an interest rate of 7% and a moderate Rate of Return. The project is thus expected to have a negative reduction cost for greenhouse gas emission reduction. However, the expected payback period of approximately 10 years is very long.

The potential CDM revenues, when assuming a credit price of $10 per CER[11], are in the range of $ 37,300 to $ 52,990. Assuming an equal distribution over the 20 years of the project, the discounted potential CDM revenues are $ 15,878 to $ 22,557 (in reality, the emission reductions per year will likely increase over the years, which would have a negative impact on the discounted potential CDM revenues). The potential CDM costs are difficult to assess, since there is no information available on aspects like time and effort spend on baseline studies, incremental investments and other administrative requirements. To estimate the potential CDM costs, we use the results of Section 3.1. This stated that for AIJ projects, the specific transaction costs were in the range of $ 30,000 per project. This cost figure is relatively fixed in nature. Since for a CDM project, a large part of the costs will be incurred before the start of the project, it is assumed that half of the $ 30,000 is incurred at year 0 and the other half is equally divided over the 20 years of the project ($ 750 a year). Then, the discounted incremental CDM costs amount to $ 21,385 for this project.

As these rough indications show, this project does not seem very attractive to apply for CDM. However, since this is a small pilot within a larger project, joining two or more projects together will cut costs and increase CDM attractiveness. Then, applying for CDM can be (moderately) attractive for the investor.

4.2 Case study Egypt: fuel switch

Emission reductions

This case study involves a fuel switch project for a number of cities and an industrial area in Egypt. Natural gas will replace three fuel sources, namely LPG (Liquefied Petroleum Gas; domestic and commercial use), mazot (Heavy Fuel Oil; industrial use) and solar (gas oil / light oil; commercial and industrial use). In two phases, approximately 83,000 domestic and commercial users and an industrial area will be connected to a newly constructed natural gas grid. Both construction phases should take three years. The project company states the lifetime of the entire project is 20 years (including construction).

As in the Philippines case study, the model presented in Section 2 was used to calculate the baseline for the project in four different ways. Again, it was inappropriate to calculate the project emissions top-down, based on national data.

Table 3 summarises the results of the baseline and emission reduction calculations. There was a large dependency on information provided by the project company, e.g. the expected gas sales. The definition and calculation of baseline scenarios (I) and (III) is the same as in the Philippines project discussed before. Scenarios (II) and (IV) appeared to be equal in this project. According to the model, the difference in approach between these bottom-up scenarios is that (II) uses the historic trend as a reference, while (IV) uses a projected future situation. However, in the data provided by the project company, the projected future fossil fuel use was based on historic use, causing the two scenarios to coincide.

Table 3: Results of calculations of baselines and emission reductions for the Egypt case study
(all figures in Mtons of CO_2-equivalents; numbers represent totals over entire lifetime)

		Description baseline scenario	Baseline emission	Project emission[1]	Emission reduction
Scenario	**I** Baseline: historic, top-down Project: bottom up	Linear extrapolation historic national trend (CO_2-eq./(GDP/cap)) and GDP/cap.	16.3	21.1	**-4.8**
	II / IV Baseline: bottom-up, projected situation is based on historic trend Project: bottom up	Emissions of fossil fuel equivalent anticipated gas sales; based on current use fuels	28.5	21.1	**7.4** ***phase 1 only: 4.73***
	III Baseline: future situation, top-down Project: bottom up	National (GDP/cap) and (emissions/(GDP/cap)) converging to current Dutch values over project period	18.3[1]	21.1	**-2.8**

[1]Project emissions were calculated as the emissions caused by the expected gas sales.
Note: A negative emission reduction means an emission increase.

Table 3 shows some remarkable results: scenarios (I) and (III) show an emission increase due to the project. However, further investigation shows that these scenarios are erring. The faulty results can be blamed on regional variations of industry density. The top-down baseline approach used in the case study implicitly assumes that the ratio of households to commercial and industrial users involved in the project is comparable to the national ratio. However, the ratio of households to industry in the project is much smaller than the national average. This leads to a serious underestimation of the baseline emissions for the project region and therefore a calculated emission increase. Thus, the top-down baseline scenarios (I) and (III) calculated for this project are highly unrealistic. If one wants to correct this, information on regional GDP is necessary. This information was not available, so it was not possible to conduct this calculation. This result confirms the statement of Ellis and Bosi [1999, p.17] that the local and regional variability of the different baseline components will determine the extent to which standardisation of the baseline is feasible. The model could only generate a baseline for case II that may be considered realistic.

Emission reduction costs and revenues

Since only scenario (II) gives a realistic result, the emission reduction under this scenario was used in calculations on costs and revenues. For the project, only cash flows for the first phase were available. The calculations in this paragraph will therefore be based on phase 1 only. The emission reductions of phase 1 total 4.73 Mtons CO_2-eq. over 20 years according to scenario calculation (2). For matters of confidentiality, only some general financial results can be given.

Without CDM revenues, the Net Present Value of the project is around 15 million US$ at a 10% interest rate, with an Internal Rate of Return over 15%. The (undiscounted) payback period is slightly less than 5 years. If one assumes a CER price of 10 US dollars, NPV would increase to over 30 million US$ (at 10%), with the Internal Rate of Return bypassing 20%. The (undiscounted) payback period would drop to 4 years[12].

The potential discounted CDM revenues (according to scenario II and a CER price of $ 10) are 19.8 million US$. The discounted incremental costs are $ 21,385. Thus, applying this project as CDM is highly attractive to the investor. However, since the project seems profitable without CDM revenues, it might not pass the test of additionality.

5. DISCUSSION AND CONCLUSIONS

This paper addressed the question whether CDM is an attractive opportunity for private investors. Based on our analysis, we conclude the following. First, most investors in CDM are expected to be companies that already operate internationally in their regular business activities. Moreover, Section 2 stated that mainly large investors are involved in CDM, since these have more chance to have the necessary expertise and are better able to cover against risks. Third, mostly 'add on' projects may be expected in CDM, since these will have relatively low (discounted) transaction costs. Finally, large CDM projects will have relatively low transaction costs because of the fixed nature of CDM specific transaction costs. This will favour large-scale projects compared to smaller ones. The case studies confirm this, showing that add on projects can financially be very attractive to an investor for large projects. However, because of the high up-front incremental transaction costs it is less attractive for small-scale projects, as the Philippines case study shows.

Thus, the cost-benefit structure of CDM causes the instrument to be especially attractive for large, internationally operating companies which apply large add-on projects as CDM. However, especially the add on character of these projects will harm the environmental integrity of the instrument. In our view, the bottom line of CDM is that it helps developing countries on a cleaner development path regarding greenhouse gas emissions. To ensure that CDM brings about cleaner development in the host countries, it is essential the instrument attracts first instance CDM projects introducing cleaner technologies. This is exactly what the criterion of additionality is meant for. Since first instance projects have a weaker financial performance, the disadvantage compared to add on projects must be kept as small as possible. It is essential to keep incremental transaction costs at a minimum, fostered by clear and straightforward procedures. This result supports the already strong call of academic and business life for simple procedures [e.g. Jepma, 2000, p.1].

Applying a project as CDM causes high transaction costs. It requires much administrative work and many negotiations. In the decision making of investors on CDM, the already high transaction costs are compounded even more because they mainly involve up-front development costs. In other words, a large part of transaction costs occur before the project generates any benefits, negatively influencing the Net Present Value of the project. CDM does offer an opportunity to both investors and cleaner development, if the method for baselines is settled down and the conditions for certification are transparent. If many different criteria will be included into the CDM, it will have a tendency to crowd out the aspect of clean development co-operation, instead of creating an additional market-based incentive for the transfer of cleaner technology.

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NOTES

[1] United Nations Framework Convention on Climate Change; the convention to which the Kyoto Protocol is linked.

[2] Organisations spoken to: CPII (Clean Project Investment Initiative; consortium of ING Bank, ECN, KPMG, ETC energy Netherlands and Gogen-projects); ECN (Netherlands Energy Research Foundation); Essent; Face foundation; Joint Implementation Network; Dutch Ministry of Housing, Spatial planning and the Environment; Netherlands Cogen Consortium; Philips;
Shell Global Solutions.

[3] Besides these actors other parties can be involved, like financial institutions or sub-contractors. Although these parties are surely important for practical or operational reasons, they are of less relevance for the investor in getting a project approved as CDM.

[4] In the Dutch pilot phase for Activities Implemented Jointly, Dutch government ensured this by demanding from the investor a letter of approval of the host country government. This letter had to state (a/o) that the project is accepted by the host country and is in agreement with the development and environmental strategy of the host country [JIRC, 2000, p.7].

[5] The distinction between JI (Joint Implementation, host country is Annex I country) and CDM (host county is non-Annex I country) was made in formulating the Kyoto Protocol in 1997. Before this, projects in both Annex I and non -Annex I countries were called AIJ: Activities Implemented Jointly. The results of the Nordic Council of Ministers are based on 10 AIJ projects in Eastern Europe. Their cost estimates are used here as very rough indications for CDM transaction costs.

[6] The estimate of the JI transaction costs is based on an assumption that donor and host country have accepted an agreement on crediting according to which approval, verification and control will be made at single project level by an impartial international authority. Moreover, it is assumed that requirements to a standardised description of the project projection, reference and annual reporting are settled.

[7] Detailed studies on baselines, problems and the effects of different baselines approaches (often based on AIJ projects) can be found in e.g. OECD [1999], Jepma et al. [1998], Ellis and Bosi [1999] and Ellis [1999].

[8] However, it is often advocated not to use the additionality constraint in the sense of financial additionality.

[9] The project emissions were calculated in a bottom-up manner only, since it was considered inappropriate and, by lack of data, impossible to calculate the project emissions in a top-down manner.

[10] For a more detailed description, the reader is referred to Van Ierland, De Leeuw and Krozer (2000).

[11] 1 CER (Certified Emission Reduction) equals 1 ton of CO_2-eq.

[12] Other assumptions: The CERs are paid for at the end of the year in which they are realised. The exchange rate used is: 0.34 US$ per £E (Egyptian Pound). This was the exchange rate at May 16, 2000.

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